

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Jeffrey P. Erhardt et al. : Confirmation No.: 1884
Serial No.: 10/817,300 : Art Unit: 2863
Filed: 4/2/2004 : Examiner: Sujoy K. Kundu
For: METHOD AND
APPARATUS FOR USING
CLUSTERING METHOD
TO ANALYZE
SEMICONDUCTOR
DEVICES

Mail Stop Reply Brief - Patents
Commissioner for Patents
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REPLY BRIEF

Sir:

The following Reply Brief is submitted in response to the Examiner's Answer of April 4, 2006, with a mail date of May 5, 2006, in the above-identified Application.

After this introductory section, there is a status of claims, there are grounds of rejection to be reviewed, and there are arguments, each starting on a separate page.

Status of claims

Claims 1-20, the only claims pending, stand under final rejection, from which rejection this Appeal is taken.

Grounds of rejection to be reviewed on appeal

Issue #1:

Claims 1-2, 6-7, 11-12, and 16-17, are rejected under 35 U.S.C. §102(b) as being anticipated by Tobin, et al. (U.S. Patent 5,982,920, hereinafter “Tobin”).

Issue #2:

Claims 3, 8, 13, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tobin, et al. (U.S. Patent 5,982,920, hereinafter “Tobin”) in view of Leung et al. (U.S. Patent 6,397,166, hereinafter “Leung”).

Issue #3:

Claims 4, 9, 14, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tobin, et al. (U.S. Patent 5,982,920, hereinafter “Tobin”) in view of Arai et al. (U.S. 2002/0145430 A1, hereinafter “Arai”).

Issue #4:

Whether the Examiner is allowed to give the broadest possible interpretation to a claim to read on an element that is not present in the prior art.

Arguments

Issue #1:

Claims 1-2, 6-7, 11-12, and 16-17, are rejected under 35 U.S.C. §102(b) as being anticipated by Tobin, et al. (U.S. Patent 5,982,920, hereinafter “Tobin”).

Regarding claims 1, 6, 11, and 16, Appellants respectfully traverse the rejections since the Appellants’ claimed combination, as exemplified in claim 1, includes the limitation not disclosed in Tobin of:

“applying a clustering method to the first data to create a clustered first data;”
[underlining for clarity]

In the Examiner’s Answer of 4/4/06 (hereinafter the “Examiner’s Answer”), the Examiner states:

“Examiner’s position is that Tobin does disclose, “applying a clustering method...to create a clustered first data” in Column 2, Lines 40-48. Tobin mentions, “categorizing the data into a plurality of categories...”” [deletion in original and underlining for clarity]

The Appeal Brief explains why the “clustering” does not read on “categorizing” and thus why the Examiner’s first sentence above and what follows is incorrect. Further, the Examiner’s first sentence above is incorrect because it is not supported by Tobin col. 2, lines 40-48, which does not mention “clustering” and states:

“These and other objects of the invention are met by providing a method of performing automated defect spatial signature analysis which includes the steps of producing a wafer map which includes data representing defect coordinates and wafer processing information, categorizing the data into a plurality of categories, each containing different types of signature events, and correlating a categorized signature event to a present or incipient anomalous process condition.” [underlining for clarity]

The above citation supports Appellants’ position by distinguishing between “spatial signature analysis” as the overall method and “categorizing” as one step in the overall method. Thus, the claimed limitation is not disclosed in Tobin, nor does the above “categorizing” into a plurality of categories disclose or make inherent a “clustering” of data. Therefore, Tobin does not anticipate claims 1, 6, 11, and 16 under 35 USC §102(b) because:

“Anticipation requires the disclosure in a single prior art reference disclosure of each and every element of the claim under consideration.” W.L. Gore & Assocs. v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303, 313 (Fed. Cir. 1983) (citing Soundscriber Corp. v. United States, 360 F.2d 954, 960, 148 USPQ 298, 301 (Ct. Cl.), *adopted*, 149 USPQ 640 (Ct. Cl. 1966)), *cert. denied*, 469 U.S. 851 (1984). Carella v. Starlight Archery, 804 F.2d 135, 138, 231 USPQ 644, 646 (Fed. Cir.), *modified on reh'g*, 1 USPQ 2d 1209 (Fed. Cir. 1986); RCA Corp. v. Applied Digital Data Sys., Inc., 730 F.2d 1440, 1444, 221 USPQ 385, 388 (Fed. Cir. 1984).

Further, Tobin does not disclose the claimed:

“applying a clustering method to the first data to create a clustered first data;”
[underlining for clarity]

The Examiner continues:

“In addition, Figure 2 shows “ clustering analysis for SPC” further described in Column 4, Lines 20-50.”

Tobin FIG 2 does not show the above nor does Tobin col. 4, lines 20-50, disclose or mention the above in either Tobin FIG. 2 or Tobin col. 3, line 50, through col. 4, line 50, which states:

“FIG. 2 shows...[t]he initial focus of wafer map signature analysis is to reduce the data set to simpler, non-overlapping (or nearly non-overlapping) sets that can be individually analyzed and finally classified to a user-defined class.

...The original density image, $\rho(x,y)$, is initially parsed into two categories...

...re-evaluated using a connectivity analysis to determine if some of the events should be removed and merged with the clustered-objects image [an image, not clustered data]. These initially random events may be moved back into the clustered image if connected groups of low-density defect pixels are found. ...

...Some standard dilation techniques are applied to the clustered image so that neighboring objects are grouped into single objects...” [deletions, underlining, and insertion for clarity]

The Examiner’s “clustering analysis for SPC” is also not disclosed in Tobin with regard to the claimed applying a clustering method “to the first data to create a clustered first data”. The Examiner’s phrase is unrelated to the claim limitation. Tobin does much further processing of the Tobin density image into various other images after which a clustering analysis is performed on the image as disclosed in Tobin FIG. 4 and 5, and Tobin col. 4, lines 40-49:

“The result of applying the masks of FIG. 4 to the original density image is shown in FIG. 5.

Distribution statistics are extracted from the global event image, and object feature measurements are extracted from the curvilinear and amorphous event images. That information is then fed into the following application areas: (1) clustering analysis for statistical process control ("SPC"); (2) intelligent sampling for off-line review, and (3) signature/process clarification.” [underlining for clarity]

Based on the above, it is respectfully submitted that claims 1, 6, 11, and 16 are not anticipated by Tobin under 35 U.S.C. §102(b) because the applying step is not disclosed and the courts have held:

“If the reference fails to teach or suggest even one limitation of the claimed invention, then the claim is not anticipated.” *Atlas Powder Co. v. E.I. du Pont De Nemours & Co.*, 750 F.2d 1569, 1574, 224 U.S.P.Q. 409, 411 (Fed. Cir. 1984).

The Examiner continues:

“Tobin also describes the original density image $p(x,y)$, is initially parsed into two categories based on defect density values: low density and high density, potentially clustered events.” [underlining for clarity, Examiner’s statement is Tobin col. 4, lines 21-24]

It is respectfully submitted that the Examiner’s statement supports Appellants’ position. First, it distinguishes between “categorization” and “clustering” since it shows that the two are not the same method. Second, it shows that the first data is categorized into two categories and one of the categories of second data may contain potentially clustered data, not applying a clustering method “to the first data to create a clustered first data”. Therefore, claims 1, 6, 11, and 16 are not anticipated by Tobin because of the holdings in *W.L. Gore & Assocs. v. Garlock, Inc.*, *supra*., and *Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co.*, *supra*.

Also regarding claims 1, 6, 11, and 16, Appellants respectfully traversed the rejections since the Appellants’ claimed combination, as exemplified in claim 1, includes the limitations not disclosed in Tobin of:

“testing a semiconductor device to produce first and second data; correlating the clustered first data with the second data to determine analyzed data.”

In the Examiner's Answer, the Examiner states:

"Examiner's position is that Tobin does disclose correlating the clustered first data. First clustered data is referred to being the categorized signature event (Column 2, Lines 40-48)." [underlining in original]

It is respectfully submitted that the above is incorrect as explained above because Appellants' "clustered" data is not Tobin's "categorized" data in Tobin col. 2, lines 48-40 (quoted above).

Further, Tobin does not disclose correlating the Tobin categorized event with second data and this is shown as the Examiner continues

"Furthermore according to the Abstract Tobin discloses, "classifying the categorized" data contained in each high level category into user label signature events, and correlating the categorized ..." [underlining and deletion in original]

In addition to the arguments previously presented in the Appeal Brief, Appellants respectfully disagree because Tobin does not disclose that the first and second data, which are correlated, are the result of testing a semiconductor device. The anomalous process condition is not the result of testing of a semiconductor device but is the condition under which the wafer is manufactured.

Based on the above, it is respectfully submitted that claims 1, 6, 11, and 16 are not anticipated by Tobin under 35 U.S.C. §102(b) because of the holding in Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co., *supra*., and Atlas Powder Co. v. E.I. du Pont De Nemours & Co., *supra*.

The Examiner continues:

"Examiner's position is that Tobin does disclose a mathematical process for categorizing. The use of the statistical process control or SPC clustering can be considered a mathematical process. Tobin refers to the use of SPC clustering in Column 5, Lines 13- 55."

It is respectfully submitted that the Examiner's position is irrelevant to Appellants' position that "applying a clustering method to the first data" is not disclosed in Tobin by the examiner reading "clustering" on the non-mathematical "categorizing". The reference to SPC clustering in Tobin col. 5, lines 13-55, is unrelated to the citation given by the Examiner to

support the equivalence of “categorizing” but relates to further processing of images after the Examiner’s “categorizing” is completed as explained in Tobin col. 5, lines 13-55:

FIG. 3 illustrates directional dilation of a set of curvilinear clusters [in an image]...

After the directional dilation is applied to the initial curvilinear image, several features of the new objects are calculated... These feature values then pass through a second fuzzy-constraint module...and sent back into the amorphous mask... FIG. 4 shows the result of the process...

Distribution statistics are extracted...and object feature measurements are extracted... That information is then fed into the following application areas: (1) clustering analysis for statistical process control ("SPC"); (2) intelligent sampling for off-line review, and (3) signature/process clarification...” [underlining, insertion, and deletions for clarity]

In the same vein, the Examiner continues:

“Examiner's position is that Tobin does disclose the clustering method (Column 2, Lines 40-48) while evaluating wafer map data and uses spatial signature analysis (Column 2, Lines 23-25).”

The Examiner's position is not supported by the cited portions of Tobin col. 2, lines 40-48, quoted above and explained above.

Tobin col. 2, lines 23-25, states:

“An object of the present invention is to provide a method and apparatus for spatial signature analysis which is capable of quickly and correctly evaluating wafer map data.”

It is respectfully submitted that this statement is not enabling because it is not related to the claimed limitations and the Examiner's detailed reading of the claim limitations on the Tobin disclosure shows that the claimed method does not read on the Tobin method. Thus, it is respectfully submitted that claims 1, 6, 11, and 16 are not anticipated by Tobin under 35 U.S.C. §102(b) because:

“[A] prior art reference may not legally anticipate a claimed invention if it does not place the subject matter of the claims within the possession of the public.” [underlining for clarity] *In re Wilder*, 429 F.2d 447, 166 USPQ 545 (CCPA 1970)

With regard to claims 5, 10, 15, and 20, the Examiner states:

“Examiner's position is that Tobin discloses analyzed data from a group consisting of wafer mapping, commonality, or correlation (Column 3, Lines 50-58).”

It is respectfully submitted that the Examiner's position above is not supported. The claimed "analyzed data" is the output of "correlating the clustered first data with the second data" in claim 1. Tobin does not disclose "analyzed data". The terms "wafer mapping", "commonality", and "correlation" are not disclosed or mentioned in Tobin col. 3, lines 50-58, which states:

"FIG. 2 shows a flow chart for software used to implement the present system. A grey-scale density image $\rho(x,y)$, is generated from the electronic wafer map for processing. That density image can be considered a composite of several overlaying events within the wafer map data. The initial focus of wafer map signature analysis is to reduce the data set to simpler, non-overlapping (or nearly non-overlapping) sets that can be individually analyzed and finally classified to a user-defined class."

The term "wafer map" refers to the starting point for generating a grey-scale density image and it would be obvious to one having ordinary skill in the art that it is not a form of "analyzed data".

Issue #2:

Claims 3, 8, 13, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tobin, et al. (U.S. Patent 5,982,920, hereinafter "Tobin") in view of Leung et al. (U.S. Patent 6,397,166, hereinafter "Leung").

Regarding claims 3, 8, 13, and 18, these dependent claims respectively depend from independent claims 1, 6, 11, and 16, and are believed to be allowable since they contain all the limitations set forth in the independent claim from which they depend and claim additional unobvious combinations including the limitation as exemplified in claim 3 wherein:

"the clustering method is K-means clustering."

The Examiner states:

"Examiner's position is that the motivation to combine the two references of Leung as taught into Tobin teaches K-means clustering. The method of K-means clustering as taught by Leung into Tobin is used to further optimize partitions within a data set as taught by Leung (Leung, Background of Invention, Lines 58-67). Although the Leung reference is related to retail sales systems, the use of K-means clustering is used to examine the data.

Appellant discloses this use of K-means clustering in the application on Page 6, Line 29 – Page 7, Line 4.”

It is respectfully submitted that the Examiner’s position is incorrect for the reasons set forth in the Appeal Brief. In addition, 35 U.S.C. 103(a) sets forth that for a proper rejection, it is necessary that “ the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains” [underlining for clarity]. A person having ordinary skill in the semiconductor art would not consider it obvious to combine the Leung retail sales system with the Tobin automated defect spatial signature analysis semiconductor manufacturing process.

It is respectfully submitted that the Examiner is assembling bits and pieces, which do not fit together when taken as a whole, to try to meet the claim limitations. Based on the above, it is respectfully submitted that claims 1, 6, 11, and 16 are not anticipated by Tobin under 35 U.S.C. §102(b) because:

“One cannot...pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.” *In re Fritch*, 972 F.2d 1260, 23 USPQ2d 1780 (Fed. Cir. 1992).

Without being facetious, it is obvious that a combination of a special signature analysis semiconductor manufacturing process would not work with a retail sales system and the courts have held:

“If references taken in combination would produce a “seemingly inoperative device”, we have held that such references teach away from the combination and thus cannot serve as predicates for a *prima facia* case of obviousness.” *In re Gordon*, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984)[deletion for clarity]

Issue #3:

Claims 4, 9, 14, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tobin, et al. (U.S. Patent 5,982,920, hereinafter “Tobin”) in view of Arai et al. (U.S. 2002/0145430 Al, hereinafter “Arai”).

Regarding claims 4, 9, 14, and 19, these dependent claims respectively depend from independent claims 1, 6, 11, and 16, and are believed to be allowable since they contain all the limitations set forth in the independent claim from which they depend and claim

additional unobvious combinations, including the limitation as exemplified in claim 4 wherein:

“the first data is selected from a group consisting of IV curves and V_t distributions.”

The Examiner states:

“Examiner's position is that both references are directed towards data manipulation in electrical based systems. Therefore the limitations in the claims suggest that the first data computes a voltage-current characteristic as shown in both references (Arai, Abstract). In addition Arai teaches the use of data manipulation starting at Column 2, Line 52 – Column 3, Line 30.”

It is respectfully submitted that the Examiner's position is incorrect for the reasons set forth in the Appeal Brief. In addition, 35 U.S.C. 103(a) sets forth the standard for a proper rejection, *supra*. A person having ordinary skill in the semiconductor art would not consider it obvious to combine the Arai battery charging system with the Tobin automated defect spatial signature analysis semiconductor manufacturing process.

It is respectfully submitted that the Examiner is assembling bits and pieces, which do not fit together when taken as a whole, to try to meet the claim limitations. Based on the above, it is respectfully submitted that claims 1, 6, 11, and 16 are not anticipated by Tobin under 35 U.S.C. §102(b) because of the holding in *In re Fritch*, *supra*.

Again, without being facetious, it is obvious that a combination of a special signature analysis semiconductor manufacturing process would not work with a battery charging system and the combination would not be obvious because of the holding in *In re Gordon*, *supra*.

Issue #4:

Whether the Examiner is allowed to give the broadest possible interpretation to a claim to read on an element that is not present in the prior art.

The Examiner states:

“Examiner's position is that the prior art discloses all the limitations presented under 35 USC 102(e) rejection thus examiner is allowed to give the broadest possible interpretation to a claim.”

Appellants respectfully submit that, regardless of how broadly a claim is interpreted, when a claimed element is not present in the prior art, the claim cannot be anticipated under 35 U.S.C. 102(e) and a full explanation of this has been given in the Appeal Brief.

Appellants also respectfully submit without being facetious that the Examiner has not applied the proper standard for rejection:

“...the PTO must give claims their broadest reasonable interpretation, this interpretation must be consistent with the one that those skilled in the art would reach.” [underlining for clarity] *In re Cortright*, 165 F.3d 1353, 1358 (Fed. Cir. 1999), cited in *In re American Academy of Science Tech Center*, CAFC 03-1531, May 13, 2004.

In conclusion, Appellants respectfully submit that, when claimed elements are missing from the combination and the combination taken as a whole is unobvious and inoperative, the claims cannot be obvious under 35 U.S.C. 103(a).

In *In re Gordon, supra.*, the CAFC held:

“The question is whether the prior art, considering its scope and content and the level of ordinary skill, must itself suggest the combination of separate elements into the claimed invention in suit, not just whether it illustrates separate elements...To illustrate this notion, you cannot claim that the existence of a unicorn should be obvious from taking a trip to the zoo and seeing a horse and a white rhinoceros in adjacent cages. It takes a spark of inventiveness to look at a horse and then look at a white rhinoceros and then conceive the idea of a white horse with a horn.”

It is respectfully submitted that it would be unobvious for one having ordinary skill in the art to arrive at the present invention by looking at an automated defect spatial signature analysis system and then looking at a retail sales system or a battery charger.

Conclusion

Claims 1-20 are patentable over the prior art.

Reversal of the Examiner’s decision is respectfully requested.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this

paper, including any extension of time fees, to Deposit Account No. 01-0365 and please credit any excess fees to such deposit account.

Respectfully submitted,



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